

cytochrome P450 family and the glutathione *S*-transferase—are now well known from both human and animal studies to play an important role in the metabolism of carcinogens.

- A better understanding of the potential differences in a tumor suppressor gene pathway in chemically induced and spontaneous kidney cancer.
- An understanding of the different capacities of cells for DNA repair. Two types of DNA repair exist: repair pathways and a tolerance mechanism. In repair mechanism, the DNA damage is removed, while tolerance mechanism circumvents the damage without fixing it.
- Increased information on the role of viruses in carcinogenesis. For example, recent reports describe how an adenovirus that has a key gene deleted can no longer reproduce itself in normal cells, but does just fine in cancer cells lacking the *p53* tumor suppressor gene. As a result, the virus kills the cancer cell, apparently without harming the normal cells.
- Advances in our knowledge of signal transduction that have led to major insights into the fundamental pathway that govern growth regulation of cells. These discoveries fulfill the long-sought ability to delineate a sequence of events from extracellular signals to nuclear responses. Additionally, key molecules in the pathway are evolutionarily conserved and mediated in an eclectic array of signals. Alterations in the pathway are important in tumorigenesis and tumor progression.
- Discovery that apoptosis—programmed cell death—is highly regulated at the molecular level by oncogenes and anti-oncogenes. Understanding the biochemical and molecular pathway that controls apoptosis is central to the cancer problem.
- The characterization of the relationship between peroxisome proliferators and cancer, including the role of cell receptors, DNA oxidation, and gene expression.
- A better understanding of the mechanism through which the leukemogen benzene affects bone marrow. Metabolites of benzene are found to be highly concentrated in bone marrow of exposed animals.
- The elucidation of generic mechanisms of action common to multiple chemicals. These studies have included nitroaromatic compounds, automotive fuels, dioxin, butadiene, chloroform and chlorine, dimethylamine, ethylene oxide, and furans.
- Increased expertise in the development of methods for conducting carcinogenic studies, including numerous assays and techniques in a range of disciplines.

In 1996, there was evidence of high momentum in both privately funded and government supported research aimed at better understanding risks to human health from exposure to environmental agents.

Clearly, environmental health research including risk assessment science is at a remarkable point in time. There is a wonderful record of accomplishments, and this accounting is only a partial list. There has been enormous progress against cancer, yet so much more remains to be done in improving the basis for understanding and assessing potential adverse effects of chemicals and consumer products on human health.

The more we know about the mechanisms involved in environmental chemical interactions with complex mammalian organisms, including both laboratory animals and humans, the more confident the public will become in estimates of human health risks, and the firmer the scientific foundation for environmental health policy formulation will become for the prevention and control of cancer and related diseases, dysfunction, and premature death. This policy and the related regulations and intervention programs shape our society and suggest priorities for investment of public health resources. The importance of these issues cannot be overstated, and the EPA appears to be moving in the right direction.

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Responsible Care and the Third World

As you point out, many environmental health scientists remain skeptical that the chemical industry's Responsible Care initiative is mainly a public relations ploy to improve the industry's dismal public image [EHP 104:1138(1996)]. Nowhere is the challenge greater than in the rapidly industrializing countries of the Third World, where corporate responsibility is not compelled by public awareness, regulation, and compensation laws.

The double standards of global corporations that operate more polluting and dangerous plants in Third World countries were described not only by industry critics but also the International Labor Office and the United Nations Center on Transnational Corporations (1,2). After the disaster at Union Carbide's plant in Bhopal, India, giant chemical producers based in the United States and Europe have been obliged to issue policy statements to the effect that they do not have lower standards for the protection

of human health and safety and the environment in their Third World operations.

When pressed, however, leading firms have been reluctant to disclose toxic release inventory data for pollution from their foreign plants as they have had to do by law in the United States since 1988. Similarly, U.S. law requires a process hazards analysis in the event of failure of safety systems, including worst-case accident scenarios—are the big companies willing to release similar analyses for their affiliates' plants in Africa, Asia, and Latin America? What about meeting modern standards for disposal of hazardous wastes from plants located in countries with no facilities available for disposing of these wastes in a manner that would meet the standards the companies face in Europe and North America? Where a control limit is opposed by a corporation as unnecessarily strict, does the company comply with the limit outside the country where the limit is in effect but being challenged in court? If a pesticide is banned for certain uses or voluntarily withdrawn from markets in the United States, does that mean it will be similarly withdrawn elsewhere? If teratogenic glycol ether solvents are withdrawn from uses in the United States because of liability considerations, will they be withdrawn from sale in other countries where no such liability exists?

Product stewardship is the most challenging area that the chemical corporations have tried to address through the Responsible Care initiative. But closer examination has shown that, in 1991, DuPont's putative product stewards were none other than the company's sales representatives. Obviously salespeople have neither the incentive nor the training to critically evaluate the industrial hygiene and pollution control measures of their customers.

To some extent, industry is being forced to develop cleaner and safer processes and products in North America and Europe. Will the companies who are making these advances in some countries rapidly transfer them around the world? Or will the companies take many years to reformulate adhesives, sealants, and paints made with toxic solvents and heavy metal pigments in Third World countries?

Responsible Care does not deal with the very sensitive subject of compensation. Bayer has operated highly hazardous chromate facilities in Mexico and South Africa and many workers and members of the surrounding communities have been harmed. Lung cancer has been recognized as a compensable occupational disease in chromate workers in Germany since 1936, but this was not entered in the schedule of occupational diseases in South Africa until 1994. When a Natal doctor attributed some work-

ers' lung cancer deaths to their occupation, Bayer steadfastly refused to pay any compensation. Perhaps the best way of getting global corporations to eliminate double standards is to have them held liable in their home countries, as U.S. companies are for the creation of toxic waste sites under the Comprehensive Environmental Response, Compensation, and Liability Act.

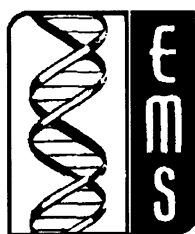
The subjects of this letter are dealt with in more detail elsewhere (3). However, it is clear that the greatest testing ground for corporate policies on health, safety, and the

environment, and industry initiatives like Responsible Care is the rapidly industrializing countries. Public health workers should subject the big companies' claims to careful international scrutiny. Curbing double standards represents both a formidable challenge and a great opportunity in environmental health.

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1. International Labor Office. Safety and Health Practices of Multinational Enterprises. Geneva:International Labor Office, 1984.
2. United Nations. Environmental Aspects of the Activities of Transnational Corporations: A Survey. New York:United Nations, 1985.
3. Castleman BI. The migration of industrial hazards. *Int J Occup Environ Health* 1:85-96 (1995).



Environmental Mutagen Society

The 28th Annual Environmental Mutagen Society Meeting will be held at the Hyatt Regency Hotel in Minneapolis, Minnesota, April 19-24, 1997. The Environmental Mutagen Society is an international society whose purpose is to engage in scientific investigation and dissemination of information relating to the field of mutagenesis and to encourage the study of mutagens in the human environment, in particular how mutagens may affect public health. The annual meeting brings together scientists from academia, industry, and government to discuss recent findings in the fields of mutagenesis and molecular genetics and their application to regulation and safety evaluation.

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